THE CURRENT PICTURE OF REST AMONG AVIATION MAINTENANCE TECHNICIANS IN AIRLINE ENVIRONMENTS

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Abstract

Since 1998, the FAA Human Factors in Aviation Maintenance and Inspection program has conducted research on physiological work conditions and technician rest. The research is an FAA response to an NTSB recommendation (A-97-71) regarding personnel fatigue in aviation maintenance. The research team collected extensive data using not only questionnaires but also sophisticated instrumentation. The research team collected sleep data and survey data from technicians working in all temperature ranges and involved repair stations and airline maintenance environments. Self-report data gathered via a questionnaire indicated that participants slept an average of 6 hours and 15 minutes per day. Sleep duration as measured with the Actiwatch sleep measurement devices was estimated to be 5 hours and 7 minutes per day on average. The potential impact of these sleep data are discussed and recommendations for dealing with potential chronic under-sleeping are discussed.

Summary of 4 Years of Observing Alertness in Maintenance

Researchers are increasingly substituting the term “fatigue research” with the newer term “alertness research,” a term attributed to Dr. Mark Rosekind of Alertness Solutions (ATA, 2000). Alertness is a more encompassing term of which fatigue is only a subset. The total aviation safety chain requires that all aviation personnel be rested, alert, and fit for duty in order to perform their tasks in a competent and safe manner. Weak links in the safety chain may lead to accidents. For example, it may be difficult for even the most rested pilot to overcome an error caused by a fatigued maintenance crew. Therefore, the importance of alertness for maintenance personnel must not be underestimated.

Workplace environmental conditions can contribute to the quality of work performance and to worker fatigue. However, each day aviation maintenance workers face sub-optimal work conditions and possible resultant fatigue. In order to better understand and quantify the aircraft maintenance work and rest environment, Sian and Watson initiated a multi-phase study in 1998. Questionnaire data collected from over 600 maintenance personnel indicated that the technicians did not see fatigue as a serious problem and they did not favor the FAA changing its rules regarding work hours. In 1999, Bosley, Miller, and Watson began the next phase of the study, which focused on measuring the physical characteristics of the work environment (light, temperature, and sound levels) along with assessing sleep patterns among technicians. They selected the Mini-Mitter data collection device to measure environmental variables and they used the Actiwatch sleep measurement device to assess sleep patterns. This phase demonstrated that these devices were applicable to the study and that there was openness in the industry to this type of research.

The FAA initiated two more studies to further examine environmental conditions and sleep patterns. Johnson, Mason, Hall, and Watson (2001) and Hall, Johnson, and Watson (2001) found that technicians slept an average of 5 hours per 24-hour period. Additionally, the research team collected environmental data demonstrating that technicians were performing many hours of maintenance work in environments (e.g. on the line, in hangars, and in aircraft) outside the human working comfort zone (Johnson et al., 2001).

Data Collection During 2001

In 2000, the research sought to collect data on hot weather working conditions. The team focused data collection on airlines in the Southeast and the Southwest from early July through September and they sought the jobs that involved working out in the environment. During 2001, the team collected the same type of data (environmental conditions and sleep patterns) during the cold winter months in the Mid-west region, providing a more complete picture of environmental factors and fatigue. While the research included the collection of environmental data, the present paper will focus on the sleep data.

The hardware data collection was supplemented with a questionnaire that included not only those participants who wore equipment but also numerous other volunteers throughout the maintenance organization. The questionnaire focused on assessing the perceived impact of environmental factors and fatigue on work performance.

Table 1 shows the timetable, location, number of shifts and number of volunteers that participated in the 2001 collection sleep data.

Table 1. Actiwatch Sleep Data Collection Timetable, Location, and Participants

Dates	Location	Shift	Number of Participants
January	Chicago	Day	0
		Afternoon	1
		Swing	9
		Total	**10**
February	Cleveland	Day	5
		Afternoon	3
		Swing	7
		Total	**15**
		TOTAL	**25**

The majority of the participants in this study was male, and most were line personnel. The research team asked for volunteers who were engaging in "hands-on" work as compared to predominately supervisory/managerial tasks. The group ranged from 27 to 54 with an average age of 39 years, thus comprising an excellent sample of the total population of aviation maintenance workers.

Data Analysis and Results

This paper presents the data in such a way that the identities of the individual participants and the companies they work for cannot be determined. Statistical analysis of the data was limited given the small and uneven sample sizes across the various groups (i.e. shifts), but appropriate and meaningful statistical comparisons are presented when necessary.

Sleep Data

The Actiwatch devices measure activity using an accurate accelerometer designed for long term monitoring of motor activity. It measures any motion and is sensitive to a force of 0.01 g. The watch can download the motion data to a computer for analysis with proprietary software to determine sleep activity and estimate the hours of sleep obtained during a sleep cycle. The Actiwatch maker also offers a number of additional measures, like sleep latency (how fast one falls asleep), sleep efficiency (sleep quality based on interrupted sleep), and other movement-related activity measures. However, for the purposes of this paper, the single focus is on the number of hours of actual sleep.

The research team asked the participants to wear the watch at all times of the day and night over a 14-day period. At the end of the data collection period, the data were extracted from the watches and stored using the Actiwatch software package. Extended periods of minimal or no activity is usually assumed to represent a period of sleep. Periods of rest (like watching television or reading a book) are usually much shorter than periods of sleep and are usually the two types of inactivity are distinguishable from each other. The Actiwatch software only allows the data analyst to identify one period of inactivity as a sleep cycle during a 24-hour time period. This is unfortunate because it is possible that a participant will sleep in “shifts”, or naps, during a 24-hour period. The software will only analyze one of these “shifts”, meaning that the data may underestimate the amount of actual sleep obtained in any given 24-hour period.

Figure 1 provides an example of the data collected by the Actiwatch, demonstrating the detail of the Actiwatch information. The dark bars on the graph represent activity, while the gaps between the dark bars indicate inactivity and, in most cases, sleep. It is important to note that even during periods of sleep, some activity (tossing and turning) is to be expected. The data analyst must mark one section of time during a 24-hour period so that the software can analyze it. The software will compute assumed sleep (the amount of time selected), actual sleep (the actual amount of sleep obtained by the wearer during that block of time), and sleep efficiency.

Figure 1: Chart Showing the Sensitivity of Actiwatch Data

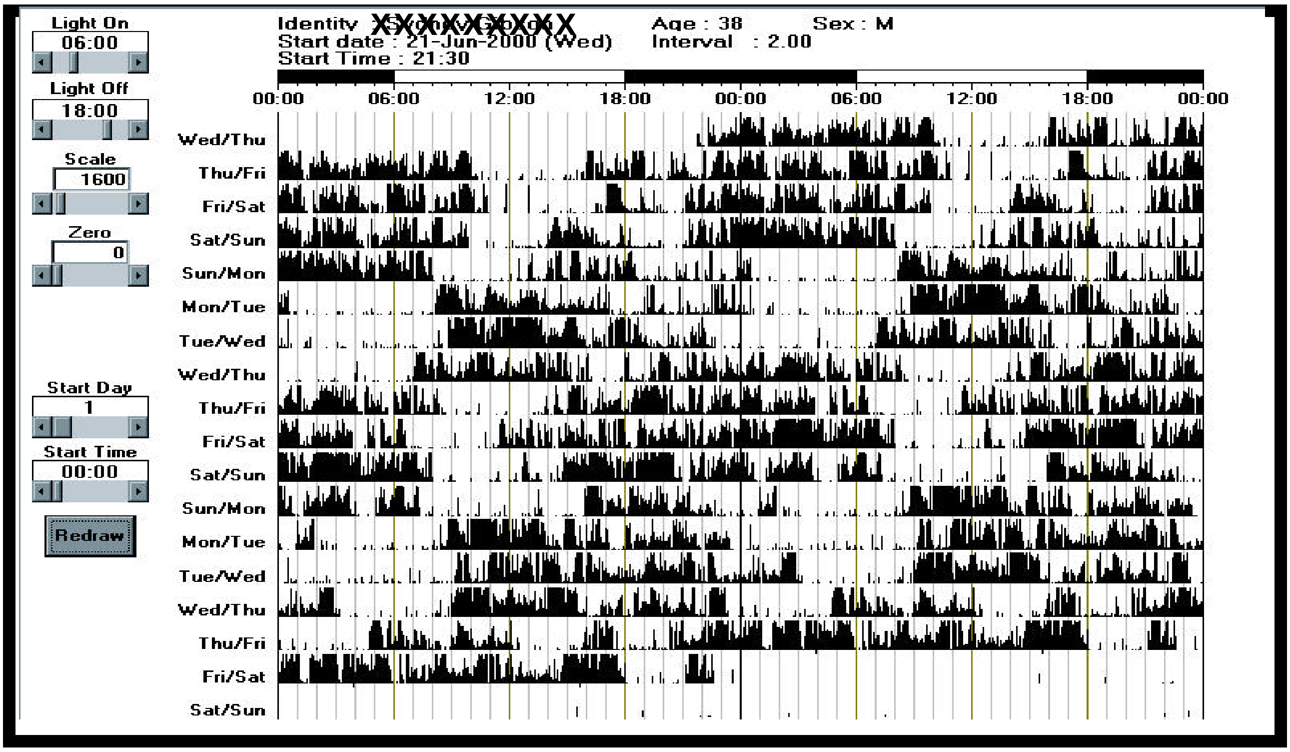


Table 2 shows the sleep descriptive data. These are aggregated data, representing sleep information across a five to 14 day period for each participant. The sample sizes reported in the table refer to the number of participants. The table presents the sleep data by shift worked. The minimum and maximum sleep values reported in the table represent the average amount of sleep reported for an individual participant. It is very likely that a participant may have obtained more or less sleep on any given night.

Average sleep duration did not statistically differ as a function of airline. The average sleep for aviation maintenance personnel across all work shifts was 5 hours and 7 minutes, which is almost identical to the average amount of sleep recording during Phase 2, the summer data collection period (Johnson et al., 2001). Given the small and uneven sample sizes across shifts, statistical comparison of sleep obtained by shift was not performed, but the general trend in the data was that average sleep decreased as the participants' shift started later in the day. There was not a significant correlation between average sleep for each participant and participant age.

Table 2: Summary of Sleep Data

Shift	Number of Participants	Minimum	Maximum	Mean	SD
Day	5	5:06	6:13	5:37	:32
Afternoon	4	4:20	5:41	5:05	:42
Swing	16	3:00	6:23	4:59	:53
All	25	3:00	6:23	5:07	:49

Questionnaire Data

The research team distributed a 29-item questionnaire to maintenance personnel at one maintenance facility in the mid-west. Forty-eight personnel completed and returned the questionnaires. The items on the questionnaire served to gather basic demographic information, information about several safety provisions in the workplace, subjectively measure alertness on the job and sleep habits, and measure attitudes about the impact of light, temperature, and noise on work performance. A copy of the survey is available on the FAA website (Hall et al., 2001).

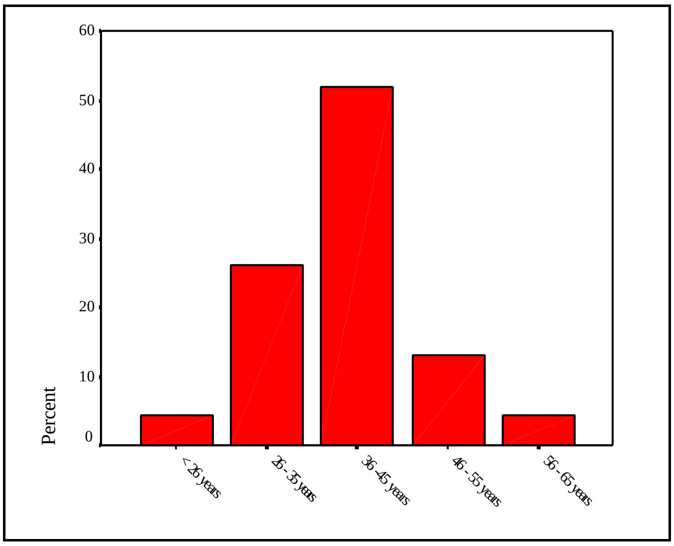
Demographics

Forty-eight surveys were completed and returned. The first ten items of the survey served to collect demographic information.

Participant Characteristics

The mean age of the participants was 39.2 years with a standard deviation of 7.9 years (N=46). Figure 2 depicts the proportion of respondents that fell into each of five age groups. As can be seen, a substantial portion of respondents (50.0%) fell in the 36 – 45 year old age bracket. The 26 – 35 year old bracket was second in size, capturing 25.0% of the respondents. There were very few respondents under 26 years old (4.2%) and none of the respondents was over 66 years old.

Figure 2. Proportion of Participants Across Age Brackets



The sample of participants was almost exclusively male (95.8%) as only 2 of the 48 participants were female.

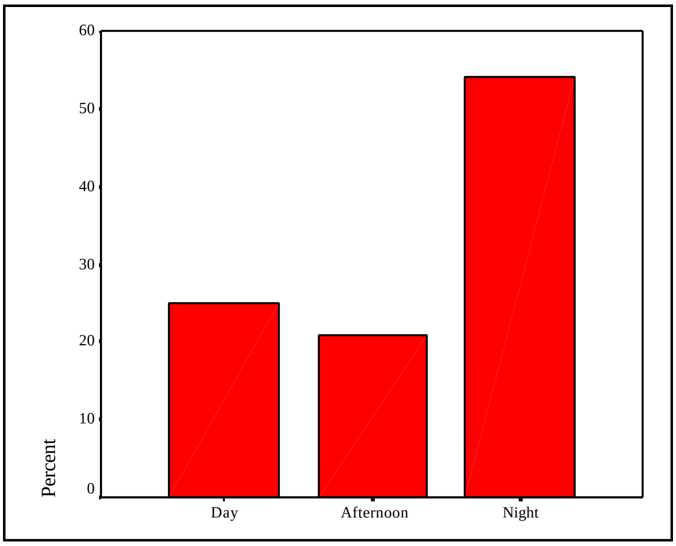
Work Role

The questionnaire asked participants about their primary work role position. Respondents chose from 11 role options and an option to specify some "other" role. The researchers recognized that most AMTs have multiple roles, but the questionnaire instructed participants to select their "primary role/position". Six individuals (12.5%) selected multiple roles, thus making it impossible to categorize them into a single role for some of the questionnaire responses. The vast majority of individuals selected line maintenance (83.3%), while 2.1% selected avionics and 2.1% selected "other."

Shift Work

Maintenance personnel at most facilities worked one of three shifts: day, afternoon, or night (also called graveyard). The questionnaire instructed participants to indicate which shift they were currently working, as shift changes are made on a periodic basis. As can be seen in Figure 3, all three shifts are represented in the sample with the bulk of participants (54.2%) working the night shift.

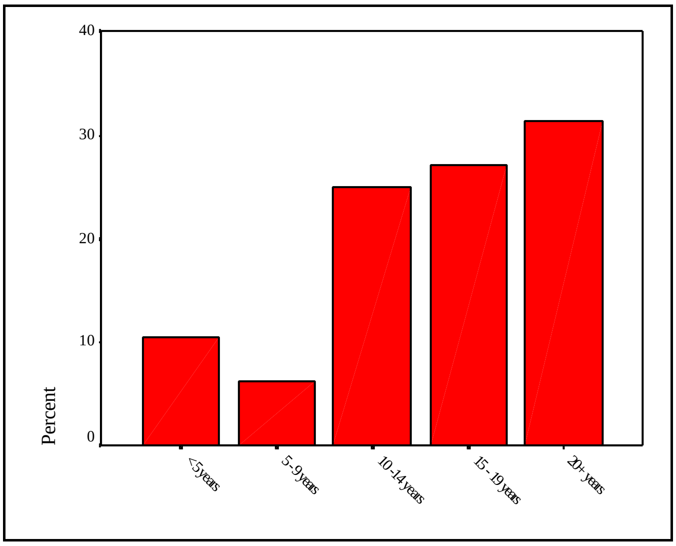
Figure 3. Proportion of Participants Working Each Shift



Job Experience

The questionnaire collected information about how long each participant has worked as a mechanic or AMT. Participants reported a mean of 16.6 years on the job (SD = 8.45, N=48). Further examination indicated that members of the sample have a wide range of time on the job, with the bulk of the participants (31.3%) having over 20 years of experience. (see Figure 4). Most importantly, these data demonstrate a broad range of experience suggested that the responses are potentially generalizable to a wide and excellent representation of maintenance personnel who clearly understand the industry.

Figure 4. Experience of Participants Working as Mechanic/AMT



Work Related Issues

Several items addressed various work issues such as working overtime, having a second job, drinking water on the job, safety training, and safety behaviors on the job. Such issues could have an impact on employee performance and safety.

Overtime

In response to the questionnaire, many participants indicated that they did not work any overtime hours on a weekly basis (45.8%), while 48% of the participants worked an average of between 1 and 10 hours of overtime per week. Overall, the average amount of overtime worked per week was reported to be 3.8 hours with a standard deviation of 6.87 hours (N = 48). These data would suggest that extensive overtime is not a major contributing factor to the low number of hours of sleep collected by the Actiwatches. Please note that this conclusion relies only on questionnaire responses and not on company work records related to overtime, consecutive days worked and other such data. For this study, the research team felt that it was too intrusive to ask companies for such data. Subsequent studies or company internal error investigations may benefit from such records.

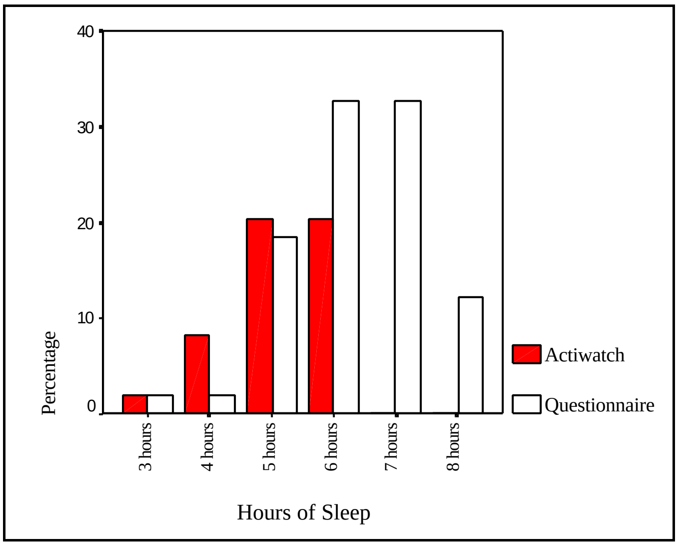
Second Jobs

With regard to external work, only 8.5% of the participants indicated they worked a second job. Again, this response would not explain the low hours of sleep collected by the Actiwatches.

Sleep

Questionnaire participants estimated the average amount of sleep they usually get each night. The average for the sample was 6.26 hours with a standard deviation of 1:00 hour (N = 48). Figure 6 shows that over 75% of the questionnaire respondents reported that they sleep 6 or more hours per night on average. However, sleep data collected from Actiwatch participants found an average sleep time of 5:07 (SD = :49, N = 25). The Actiwatch data also indicates that 84% of the participants slept less than an average of 6 hours per day. It is important to note that the questionnaire data and the Actiwatch data came from two different groups of maintenance technicians. This difference in data, between Actiwatch and questionnaire, may be attributable to numerous factors. First, the respondents may be over reporting their sleep. Secondly, the Actiwatch is very accurate and does not count the initial “tossing and turning” as sleep. Thus, there is a likely difference between time spent in bed versus actual sleep time. Third, it is possible but not necessarily likely that the two groups completing the questionnaire and wearing the Actiwatches differed in terms sleep patterns. In any case, the combination of the Actiwatch data with the questionnaire data and with the previous fatigue questionnaire (Sian & Watson, 1998) strongly suggests that maintenance personnel are not fully aware of their sleep duration and the possible fatigue that may result.

Figure 6. Questionnaire and Actiwatch measures of Average Sleep Per Night



The sleep data can be examined further by comparing the average amount of sleep reported across the three shifts worked. As can be seen in Table 3, the night shift participants reported fewer hours of sleep per day as compared to the day and afternoon shift participants. Statistical analysis indicated that the night shift participants reported significantly less sleep than the afternoon shift participants did, but the other group differences were not statistically significant. While there are statically significant differences across shifts in self-reported estimates of sleep, the Actiwatch data discussed previously shows a similar trend, but does not follow suit. This could be because of a much smaller sample size for the Actiwatch data, thus limiting the statistical power of any analyses performed on those data.

Table 3: Average Actual Sleep by Shift

Shift	N	Mean	Standard Deviation
Day	12	6:38	:51
Afternoon	10	6:51	:49
Night	26	5:52	:59
All	48	6:16	1:00

Factors Affecting Work Performance: Sleep and Alertness

Most of the second half of the survey measured perceived problems with work lighting, temperature levels on the job, noise levels on the job, sleep habits, and level of alertness on the job. Again, we report only the sleep data herein. Six-point Likert-type items assessed each of the five factors. In order to avoid response sets, some items were negatively worded. Reversing the order of the questions encourages the respondent to read each question carefully. The items were designed to assess the extent to which each factor is problematic. For example, the questionnaire asked participants about the adequacy of lighting on the job as well as whether or not they felt their job performance suffered due to sub-optimal lighting conditions. The items were reverse scored when appropriate and combined to form five sub-scale composite scores with possible values ranging from 1 to 6. The scoring was done so that sub-scale values towards 1 indicate that the factor is not problematic, while sub-scale values towards 6 indicate that the factor is perceived to be problematic. Sub-scale scores are a relative index in that the absolute values of the scale scores are not of primary interest. Scores can also be compared across groups (e.g. shift worked) or across scales (i.e. sleep vs. light vs. noise, etc.). These scores are used as an indicator of which factors the participants view as the most problematic, therefore giving some guidance as to which factors should be given the most attention by airline management.

Sleep

Four Likert-type items addressed participant sleep habits. Specifically, these items assessed the extent to which participants felt they obtained both the quality and quantity of sleep they need to function properly. Overall, the average score for the sleep sub-scale was 3.59 with a standard deviation of 1.32, but there were significant differences in sub-scale scores as a function of shift worked (see Table 4). Statistical analysis indicated that night shift participant scores were significantly higher than the day shift scores, indicating that the night shift participants feel that they do not obtain as much or as good of sleep as their day shift peers. The afternoon shift scores were not statistically different from the day or night shift scores.

Table 4: Sleep Sub-scale Scores by Shift

Shift	**N**	**Mean**	**Standard Deviation**
Day	12	2.79*	1.27
Afternoon	9	3.22	1.28
Night	26	4.08*	1.17
All	47	3.59	1.32

**Significantly different from each other (p<.05).*

Alertness

Two items on the questionnaire assessed the extent to which participants felt alert and awake on the job, and responses to these items were combined to form a sub-scale score. The overall average sub-scale score was 3.23 with a standard deviation of 0.97. Scores across shifts did not vary much (see Table 5). Additionally, examination of the responses to these items indicates that most participants generally feel alert on the job even though they may sometimes feel a little bit tired on the job.

Table 5: Alertness Sub-scale Scores by Shift

Shift	N	Mean	Standard Deviation
Day	12	3.17	1.09
Afternoon	9	2.94	.73
Night	26	3.37	.99
All	47	3.23	.97

Other Factors

As discussed above, the questionnaire also addressed light, temperature, and sound level as factors that may affect performance. The sub-scale scores for those factors were 3.19, 431, and 2.60, respectively. In context, it appears that technicians see extreme temperatures as more problematic than sleep or alertness issues. On the other hand, light and sound level factors were seen as less problematic than sleep or alertness issues.

Implications of the Survey Data

Setting Priorities

These data indicate that many workers view temperature as being a problematic environmental factor on the job, while noise was viewed as least problematic. This perspective was held across the different shifts worked. Therefore, it seems that airline management should strive to mitigate the impact of extreme temperature with portable cooling, and other such measures. However, it is also interesting to note that self-reported sleep habits did not correspond with sleep habits as measured by the Actiwatch devices. This fact may indicate that the technicians overestimated the amount of sleep they obtain on a regular basis and potentially explaining the technicians did not see sleep and alertness issues as the most problematic issues facing them on a daily basis.

Recommendations

The complete report makes recommendations regarding temperature, light, and sound pressure (Hall et al., 2001). This paper addresses only the sleep data. Table 6 shows summary Actiwatch data and the recommendations for sleep. Most researchers advocate an average sleep requirement for adults is 7.5-8.0 hours per day.

Table 6: Actual Sleep vs. Recommended Sleep

Mean Overall Sleep Experienced by Participants	Recommended Levels by Carskadon & Dement as cited in Battelle, 1998
Mean : 5:07 sleep per night	7:30 to 8:00 sleep per night

These data clearly show that airline maintenance personnel sleep about 5 hours per day. All sleep experts agree that 5 hours is not enough sleep (Battelle, 1998). The experts would argue that the population of maintenance personnel is acquiring a daily "sleep debt" of, at least, 2 hours. Since the technicians wore the Actiwatch 7 days a week for the two-week data collection period, it does not appear that maintenance personnel are repaying the sleep debt. However, the questionnaire data do not reflect a population that perceives chronic fatigue or tiredness. The data collected from the Actiwatch strongly suggest that the population of aviation maintenance workers has a sleep deficiency problem and has not yet acknowledged that potential problem.

Changing the culture of aviation maintenance personnel to sleep more hours is likely to be difficult. It may also be difficult to make management understand and appreciate the significance of this sleep pattern. In most cases, the managers came up through the ranks of the maintenance personnel and are likely to have the same short sleep patterns. Education may be the only way to accomplish this cultural change. During the data collection, the research team observed that the personnel who wore the Actiwatch became sensitized to their sleep habits. It is likely that airline maintenance personnel are simply unaware of their sleep habits versus the recommended sleep amounts. Airlines could use equipment like Actiwatches to help technicians to understand their sleep habits and form improved habits if necessary. While this is only speculation, the productivity return on investment would quickly justify the cost of the equipment, administration personnel, and training. Subsequent phases of this research program could determine the extent of error and associated cost attributable to worker fatigue.
Another possible manner to motivate personnel, with respect to sleep, is to initiate an education campaign related to "Fitness for Duty." While many associate "Fitness for Duty" with alcohol or drugs, it can also apply to sleep. Of course, sleep deprivation is not as easy to define or measure relative to alcohol or drug use.

If personnel can learn to recognize fatigue, they can help one another to avoid the inevitable performance degradation and potential error. During 2000, the Air Transport Association (ATA, 2000) published the *Alertness Management Guide*. The document was designed for flight crews but has applicability to everyone. The ATA guide offers quick explanations of the importance of sleep as a vital physical need. It strongly endorses the importance of the 8-hour sleep requirement and the "debt" that accumulates. Among the many recommendations offered are such actions as the following: Minimize sleep loss; alter habits to acquire necessary sleep; create the right environment for sleep and; the effect of age, alcohol, diet, and exercise on sleep. This type of guideline and education program should be implemented for maintenance personnel. The labor unions, companies, or the FAA through this research program should foster such informational activity.

Using Environmental and Fatigue Data to Predict Error

Boeing's maintenance error Decision Aid (MEDA) incident procedures and the US Navy's Human Factors Classification System (HFACS) collects no quantitative data on fatigue, heat, light, or sound. The Boeing system (see Table 7), specifically Sections F and G of the MEDA form merely allows a check box for Fatigue, Noise, Lighting, Hot, and Cold. Investigators can add specific data regarding any of these factors; however, that is seldom done with respect to these investigations. A study by Johnson and Watson (2001) reviewed numerous

MEDA investigations and the environmental factors were the lowest category of contributing factors. When an investigator checks fatigue as a factor, it is seldom quantified. One airline said they had a rare incident investigation where they found that the technician who erred was just completing a double twelve-hour shift. That airline readily reported to the research team that such information is seldom discovered or reported regarding an incident. Instead, the contributing factor may be “failure to use the proper tools and equipment.” In reality, the technician was too tired to go a get the manual and/or tools and chose to proceed with the available information and tools.

The research team contemplated creation of a detailed MEDA-like form for collection of very specific data related to environmental and rest data. Those checklist/forms would include the kind of data reported in Section 3 of this report. After considerable discussion, the team surmised that such a form would be an academic exercise and not likely to find widespread use at this time. This is because, generally, the industry is not very good at collecting the high-level MEDA data much less the details associated with environmental conditions and perceived fatigue. If the airlines, or the FAA, decides to include such data as part of the Continuous Analysis and Surveillance System (CASS) the data could include such information as the following: amount of overtime worked in the week of incident, number of consecutive shifts worked at the time of the incident, temperature, humidity, lighting conditions, noise levels, and such factors.

Table 7. Environmental and Fatigue Sections of MEDA

N/A __	**F. Individual Factors**			
	__ 1.	Physical health (including hearing and sight)	__ 6.	Body size/strength
	__ 2.	Fatigue	__ 7.	Personal event (e.g., family problem, car accident)
	__ 3.	Time Constraints	__ 8.	Workplace distractions/ interruptions during task performance
	__ 4.	Peer Pressure	__ 9.	Other (explain below)
	__ 5.	Complacency		
	Describe specifically how the selected <u>factors affecting individual performance</u> contributed to the error.			

N/A __	**G. Environmental/Facilities**					
	__ 1. High noise levels		__ 6. Snow		__ 11.	Hazardous/toxic substances
	__ 2. Hot		__ 7. Lighting		__ 12.	Power sources
	__ 3. Cold		__ 8. Wind		__ 13.	Inadequate ventilation
	__ 4. Humidity		__ 9. Vibrations		__ 14.	Other (explain below)
	__ 5. Rain		__10. Cleanliness			
	Describe specifically how the selected <u>environment/facilities</u> factor(s) contributed to the error.					

Summary and Recommendations for Next Steps

Three Phases Completed – A Summary

The research team has now collected data in all seasons, from airlines and from repair stations. The environmental data are based on nearly 125 participants, wearing the sophisticated MiniLogger equipment for over 10,000 hours of data collection. The sleep duration data are based of over 150 participants, wearing the Actiwatches for over 50,000 hours of data collection. Since the start of this effort the research team has collected over 1000 questionnaires, from maintenance technicians, reporting on rest, fatigue, and environmental factors associated with work performance. This is a significant amount of accurate and reliable data. That means there is very high confidence in the summary statements.

The assessment of sleep duration showed that the population of aviation maintenance technicians, throughout the industry, is sleep deprived. This is a certain finding and represents a risk to safe work performance. This statement is independent of age, experience, type of company, season of the year, etc., and it is exacerbated by shift work schedules. Based on the data, low and insufficient sleep duration appears to be a cultural characteristic of the aviation maintenance workforce. The questionnaire data strongly support the fact that this general pattern of insufficient sleep is not a result of extended work hours. Further, the combination of the measured data and the questionnaire data indicate that AMTs are not cognizant of the fact that they do not get enough rest. This is a problem, one that the industry must address.

Recommendations

The first three phases of this research have shown that the area of greatest need relates to challenges associated with the sleep duration habits of AMTs. Therefore, the suggestions herein are associated with changing the culture of technicians. That culture change is most likely to be successful if it combines awareness training, behavioral modification, and on-going reporting. The US Department of Health, the Department of Transportation, the National Sleep Foundation, and other government and private organizations prepare educational materials for education about alertness, fatigue, and sleep. The research team recommends creation, implementation, and evaluation of such programs specifically designed for the aviation maintenance work force.

Awareness

This paper has discussed the sleep duration habits of aviation maintenance technicians. The data show that insufficient sleep seems to be a cultural trait of the workforce. The research team suggests that the FAA should create materials for a sleep importance awareness campaign for the AMT workforce. These materials should include brochures, signage, and training material focused on the aviation maintenance workforce. While such materials can and should capitalize on existing government documents, they should be designed specifically for the aviation maintenance workforce. Such materials can be used throughout the maintenance organization. This recommendation is likely to have immediate recognition by the workforce. The FAA cannot create regulations regarding hours of sleep. Proper industry awareness, education, and motivation are the only ways to begin to affect the aviation maintenance culture with regard to sleep.

Training

This recommendation is closely aligned with the awareness campaign above. The FAA should create the training program to make technicians aware of issues related to fatigue and alertness. This program can have a format similar to the documents created for Maintenance Resource Management. Those materials included published guidelines, on the FAA website, a Computer-based training program, and finally an Advisory Circular. These materials, ultimately, could provide enough information to create an excellent video program, when funding is available from FAA or industry.

Behavioral Modification

Changing a culture will require large-scale behavior modification. This means that the research must be able to show AMTs their current behavior, show them how to change the behavior, and measure that behavioral change along the way. One of the findings of this research was that maintenance technicians tend to overestimate the amount that they sleep, and therefore are not likely to see a need to modify their sleep patterns. It may be possible to change these beliefs and subsequently change sleep behavior by providing feedback regarding the amount of sleep obtained on a regular basis. The Human Factors and Systems Department at Embry-Riddle Aeronautical University is currently conducting research to determine if feedback training can result in a change in sleep behavior. The research will use the same Actiwatch technology to assess sleep duration and provide feedback to participants on a daily basis. The hypothesis is that feedback regarding the amount of sleep will encourage people to modify their sleep habits and to sleep more hours as a result.

On-going Reporting

The research team recommends the creation of a system to better track the relationship between fatigue and maintenance error. This task has many challenges. First, the industry must generate additional internal, or external, motivation to increase the quantity and quality of error investigations. The current companies that use MEDA or HFACS to their full capability would have to raise the level of their error investigation techniques with respect to fatigue. This can happen if the FAA makes such data collection an airline requirement. It would behoove the industry to explore the value of such data in advance of FAA action. Whether it is a Continuous Analysis and Surveillance System requirement or an airline voluntary action, investigators must be trained to recognize situations were fatigue might be a contributing factor. This can be done only if the FAA and the industry make it a high priority before a serious incident or accidents brings the fatigue issue into the public eye.

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